

PARALLEL CIRCUITS TROUBLESHOOTING

Troubleshooting parallel circuits depends on the understanding of the theoretical operation of a parallel circuit. FIGURE 3, consist of R_1 , R_2 , and R_3 in parallel to a 40 volt power supply.

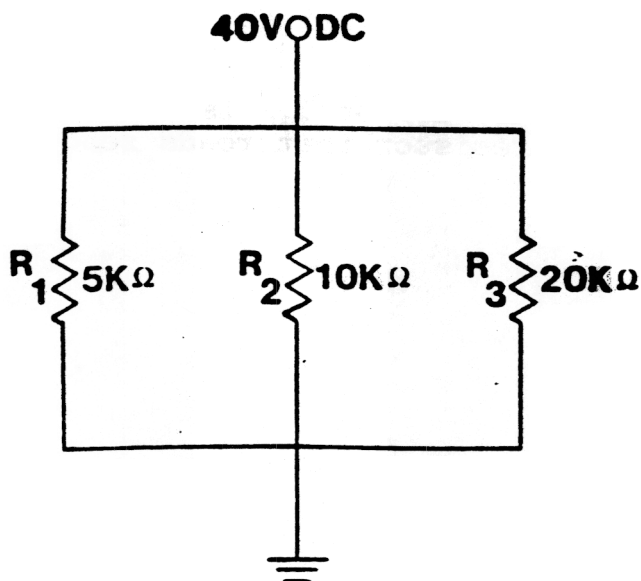


FIGURE 3 (EP14AL-S03)

Voltage measurements cannot be used to isolate a malfunction in a parallel circuit because the voltage drop across each branch will be the same.

Short: The voltage drop across every branch will be 0V

Open: The voltage drop across the circuit may increase but voltage drops across each branch will be the same.

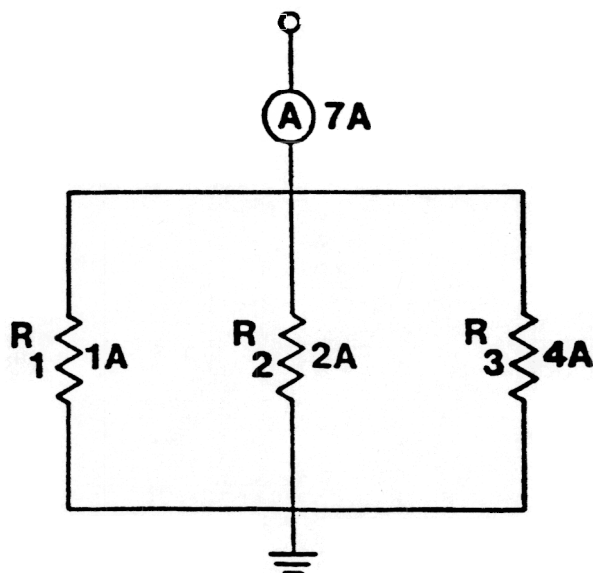


FIGURE 4 (EP14AL-S04)

Current measurements can be used to isolate the opens in parallel circuits. Sometimes an ammeter is built in the equipment and the repairman has to read and interpret the current reading.

Referring to FIGURE 4, as an example, the ammeter (I_T) reads:

7A.....Circuit is operating properly.
6A.....R1 is open.
5A.....R2 is open.
3A.....R3 is open.

Much higher than 7A indicates a short, and some type of safety device is keeping the power supply from burning up. Power should be turned off.

Zero amps would indicate that the power supply is inoperative or there is an open between the parallel circuit and the power supply or ground.

Resistance measurements are best for troubleshooting shorts. With power disconnected, damage will not come to the circuit from an overflow of current. Resistance measurements can also be used to isolate opens.

In FIGURE 5, malfunction can be handled as follows;

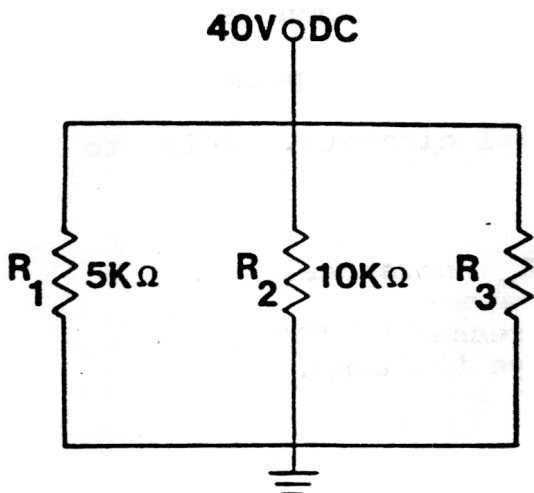


FIGURE 5 (EP14AL-S05)

If total resistance (R_T) across the circuit goes up an open is indicated in one of the resistors.

If total resistance (R_T) across the circuit goes to zero ohms a short is indicated.

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To further isolate the malfunctioning component, using resistance measurements, each branch must be disconnected from the circuit before measuring.

During the PRACTICAL EXERCISE you will troubleshoot using this procedure:

Measure the voltage across each parallel branch
All branch voltages should be the same.
With an unregulated power supply,

Open - voltage increases,
Short - voltage decreases to "0" or a very low value.

Break the circuit to measure current;

Open - I_T is lower than normal.
Short - I_T is higher than normal.
Same as I_T indicates a shorted branch.
Normal reading indicates there is not any branch trouble.
"0" current = Open Branch

Confirmation check - Make resistance measurements;

Turn the OFF power.
Isolate each branch.
"0" ohms indicates shorted branch.
Normal reading indicates no branch trouble.
 ∞ ohms indicates the branch is open.

Malfunction indications in a parallel circuit.

Opens in parallel circuits. (Refer to Figure 5)

R1 open.

R_T or R_{eq} increases.
 I_T decreases.
 I_{R1} decreased to "0".
 I_{R2} stays the same.

R2 open.

R_T increases.
 I_T decreases.
 I_{R1} stays the same.
 I_{R2} decreases to "0".
 I_{R3} stays the same.

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R3 open.

R_T increases.
 I_T decreases.
 I_{R1} stays the same.
 I_{R2} stays the same.
 I_{R3} decreases to "0".

QUESTION: What happens to the equivalent or total resistance in a parallel circuit if one of the resistors open?

ANSWER: Equivalent or total resistance increases.

Short in parallel circuits

If a short occurred in a parallel network, R_T would be zero ohms for the parallel network.

Total current would rise.

Voltage measurements cannot be used to troubleshoot shorts in parallel circuits because there would be little or no voltage drops across the circuit.

Since shorts allow an abnormal amount of current to flow in the circuit, damage to the circuit can occur. A circuit protection device may open the circuit.

CAUTION: Before repairing damaged capacitors or resetting the circuit protection device, the circuit should be checked for less than normal resistance.

SUMMARY:

An open in a parallel circuit causes R_T to increase thus causing I_T to decrease. A short across a parallel circuit causes the parallel circuit to be a shorted, thus R_T to "0" ohms and I_T goes to maximum, which usually causes damage. Voltage measurements cannot be used to troubleshoot parallel circuits conclusively.